

REMARKS

The Examiner has rejected claims 1 and 8-14 under § 103 as being unpatentable over Iizuka et al. U.S. Patent No. 6,596,602 in view of West U.S. Patent No. 5,577,263. Claims 1, 8-19 and 21-23 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-25 of U.S. Patent No. 6,921,711, as listed in the previous Office Action.

Rejection Under § 103 Over Iizuka et al.

With respect to claims 1 and 12-14, Applicants have amended claim 1 to more specifically recite the structure formed by the method, namely a gate stack of an integrated circuit. The substrate is a semiconductor substrate that includes a high-k layer formed on an oxide, nitride or oxynitride interface layer. The rhenium metal layer is deposited on the high-k layer, and the Si-containing or C-containing passivation layer is formed on the rhenium metal layer. This particular structure is neither taught nor suggested by Iizuka et al. in view of West. Thus, Applicants respectfully request withdrawal of the rejection under § 103 as to claims 1 and 12-14.

With respect to claims 8-9, Iizuka et al. refer to the problem of oxygen depletion in Col. 8, lines 21-25. By using ALCVD to deposit the high-k layer, the high-k layer does not need to be subsequently annealed in an oxygen environment before depositing subsequent layers on the high-k layer. Iizuka et al. simply state that annealing of the high-k layer can be eliminated as a result of their invention, not that it should be avoided. Moreover, there is no teaching or suggestion by Iizuka et al. in view of West of annealing a gate stack to diffuse Si, C, O or B into a rhenium layer to convert the surface portion of rhenium to a rhenium silicide, rhenium carbide, rhenium oxide or rhenium boride passivation layer. The annealing step in the instant claims is conducted after the rhenium metal layer is deposited on the high-k layer, whereas the annealing step eliminated by Iizuka et al. would have been conducted before a metal layer would be

deposited on the high-k layer to provide oxygen to the high-k layer. It is respectfully suggested that Examiner has misunderstood the reference and its teachings. Thus, Applicants request withdrawal of the rejection under § 103 as to claims 8-9.

With respect to claims 10-11, there is no teaching or suggestion by Iizuka et al. in view of West of a method that includes depositing a rhenium metal layer from a rhenium carbonyl precursor followed by exposing that rhenium metal layer to both a metal carbonyl precursor and a Si-, C-, O-, or B-containing gas to deposit a metal silicide, metal carbide, metal oxide or metal boride on the rhenium metal layer. Applicants do not see how the passage at Col. 10, lines 36-44 referred to by Examiner could be interpreted to provide the alleged teaching or suggestion. Thus, Applicants request withdrawal of the rejection under § 103 as to claims 10-11.

Obviousness-Type Double Patenting Rejection

Applicants respectfully assert that Examiner has confused the concepts of domination and double patenting. As stated in MPEP 804, "Domination and double patenting should not be confused. They are two separate issues. One patent . . . dominates a second . . . application when the first patent . . . has a broad or generic claim which fully encompasses or reads on an invention defined in a narrower or more specific claim in another . . . application. Domination by itself, i.e., in the absence of statutory or nonstatutory double patenting grounds, cannot support a double patenting rejection." (citations omitted.) Nonstatutory double patenting only exists when the claimed subject matter is merely an obvious variation from the subject matter claimed in the patent. It is respectfully asserted that is not the case here. The MPEP states that "Any obviousness-type double patenting rejection should make clear: (A) The differences between the inventions defined by the conflicting claims – a claim in the patent compared to a claim in the application; and (B) The reasons why a person of ordinary skill in the art would conclude that the invention defined in the claim at issue would have been an obvious variation of the invention defined in a claim in the patent." The Examiner has not provided a

statement of the differences, and has only stated "elimination of a gate structure is an obvious variation." It is not clear how that statement relates to the claims of the present application and the cited patent. If it was the intent of the Examiner to assert that the diffusion barrier layer overlying said first layer could be eliminated from the structure recited in the patent claims, Examiner is reminded that a proposed modification cannot change the principle of operation of the reference. The diffusion barrier layer plays a primary role in the invention claimed by Cabral et al., and elimination of that layer would defeat Cabral et al.'s intent and undo the advantages of their invention that are attributed to the presence of that layer.

With respect to claims 1 and 12-14, there is nothing in the claims of Cabral et al. that teach or suggest a variation of Cabral et al.'s claimed structure in which a first layer (on a high-k layer) is rhenium and a next layer on the rhenium layer is a silicon- or carbon-containing layer.

With respect to claims 8-9, there is nothing in the claims of Cabral et al. that teach or suggest a variation of Cabral et al.'s claimed structure in which a first layer (on a high-k layer) is rhenium, and the rhenium layer is exposed to Si, C, O and/or B gas and the structure annealed to diffuse the Si, C, O and/or B into the rhenium to convert the surface portion of the rhenium layer to a respective rhenium silicide, rhenium carbide, rhenium oxide and/or rhenium boride. Claim 8 has been amended herein to add the language that at least the surface portion of the rhenium layer is converted.

With respect to claims 10-11, there is nothing in the claims of Cabral et al. that teach or suggest a variation of Cabral et al.'s claimed structure in which a first layer (on a high-k layer) is rhenium, and the rhenium layer is then exposed to both a metal carbonyl precursor and a Si, C, O and/or B gas to form a respective metal silicide, metal carbide, metal oxide and/or metal boride on the rhenium layer. Neither the order of the layers nor their method of deposit is obvious in view of the claims of Cabral et al.

With respect to claims 15-19 and 21-22, there is nothing in the claims of Cabral et

al. that teach or suggest a variation of Cabral et al.'s claimed structure in which a first layer (on a high-k layer) is rhenium and a next layer on the rhenium layer is tungsten, and a next layer on the tungsten is silicon. In Cabral et al., there is always a diffusion barrier layer between the first layer and the tungsten layer, which barrier layer cannot simply be eliminated as an obvious variation because the elimination of the barrier layer would be a change to the principle of operation of the reference. There is further no teaching or suggestion in the claims of Cabral et al. of depositing a silicon layer onto the tungsten layer, such that it cannot be deemed a mere obvious variation in view of the claims of Cabral et al. With respect to claim 22 specifically, there is also no teaching or suggestion of the specific method steps of annealing after the tungsten and silicide layers are deposited to convert the layers, at least in part, to tungsten silicide.

With respect to claim 23, there is nothing in the claims of Cabral et al. that teach or suggest a variation of Cabral et al.'s claimed structure in which a first layer (on a high-k layer) is rhenium, followed by a particular sequence of method steps to form a passivation layer on the rhenium layer, specifically, first forming a metal layer on the rhenium layer, second, exposing the metal layer to a gas, and third, diffusing the atoms from the gas into the metal layer to convert the metal layer to a metal silicide, metal carbide, metal nitride, metal oxide and/or metal boride.

In view of the foregoing amendments to the claims and remarks given herein, Applicants respectfully believe this case is in condition for allowance and respectfully request allowance of the pending claims. If the Examiner believes any detailed language of the claims requires further discussion, the Examiner is respectfully asked to telephone the undersigned attorney so that the matter may be promptly resolved. The Examiner's prompt attention to this matter is appreciated.

Applicants are of the opinion that no additional claims fee is due as a result of this Amendment. Applicants are also of the opinion that a one-month extension of time is due with this Amendment. Payment of all charges due for this filing is made on the attached Electronic

Application No. 10/711,717
Response dated July 24, 2006
to Office Action mailed March 22, 2006

Fee Sheet. If any additional charges or credits are necessary to complete this communication,
please apply them to Deposit Account No. 23-3000.

Respectfully submitted,

WOOD, HERRON & EVANS LLP.

By: /Kristi L. Davidson/
Kristi L. Davidson, Reg. No. 44,643

2700 Carew Tower
441 Vine Street
Cincinnati, OH 45202
513/241-2324 (voice)
513/241-6234 (facsimile)
K:\RA\J025\response to 032206 OA.doc